Cannabis Industry Services

Leading the way to necessary medical cannabis research

Powered by MSA

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msa Management Science Associates, Inc.

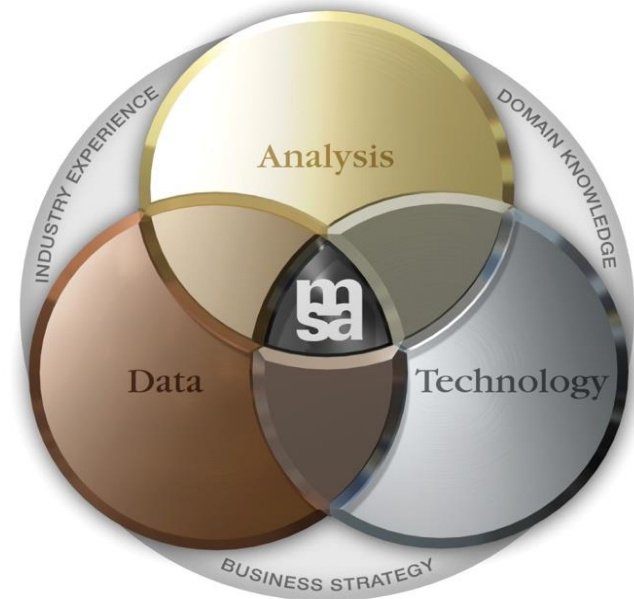**Driving data science innovation since 1963**

Data Analytics | Data Management | Information Technology

96% retention rate

Client success is important to MSA, we strive to achieve high client satisfaction and ROI values for our partners.

Management Science Associates, Inc.

Combining expertise with analytics, data management and information technology across CPG, Life Sciences, Media, Metals & Materials, Gaming and Cannabis.

MSA helps clients put their data to work.

Cannabis Research: Untapped Opportunity

The Cannabis industry lacks quantitative, real-world data.

◆ Over the decades, the cannabis industry has seen an increased number of anecdotal and survey-based data often resulting in limited findings.

◆ MSA is well positioned to advance scientific research, discover untapped benefits of cannabis and educate audiences using reliable, real-world data.

◆ Our strategic partnerships, collaborating directly with state regulators and government entities, and working alongside legal cannabis operators can provide new insight and opportunity.

How Research Works

◆ MSA conducts cannabis studies using its multi-patented, HIPAA-compliant de-identification engine to de-identify and link multiple diverse data sources at the individual level while maintaining privacy.

◆ MSA can link cannabis operators' point-of-sale data with MSA's real-world healthcare data to analyze which cannabis products are most effective in helping patients with specific health and wellness needs.

◆ MSA is dedicated to advancing scientific research within the cannabis industry.

Unique Actionable Integrated Data Set: Linking Real World Data

- **National consumer purchase panel data**
  - Approximately **330,000 lives**

- **Lab test results** (e.g., HbA1C and cholesterol)
  - Approximately **200 million lives**

- **Electronic health records** (e.g., Opioid, GLP-1 Medications)
  - Approximately **30 million lives**

- **Cannabis POS data**
  - Approximately **30 dispensaries and growing**

- **Medical claims**
  - Approximately **40 million lives**

- **Digital behavior data**
  - Approximately **120,000 lives**

- **Client first party data**

Strategic Applications & Execution Strategies

Applications:

- **Consumer Journey mapping**

- Behavior change around cannabis use in correlation to state legal prescription use

- Predictive modeling to drive marketing campaigns (i.e., Targeted Doctor Outreach Programs)

- Market Impact, fair share, and repeat rate by consumer segment

Execution strategies :
- Provide research findings to government officials, research entities, and cannabis operators.
- Drive educational campaigns in communities.
- Partner in funding opportunities for cannabis research- Local, State, and Federal.
- Make better informed recommendations for your cannabis patients.

MSA Partners with Vireo Health

- Through MSA's patented and nonreversible process to remove identifiable health care data, MSA partnered with Vireo Health to conduct a first-of-its-kind study.

- MSA used its platform- along with its deidentification and matching features- to determine that customers of eight dispensaries in Minnesota were able to reduce their legal opioid use by an average of 30% using medical cannabis.

- These insights are especially of use in the medical cannabis industry, which does not yet have the level of rigorous deep dives that the pharmaceutical industry has had through research and clinical trials.

Changes in Cannabis Purchasing Behavior

To study the impact of cannabis purchases on opioid prescriptions, we focused on a three-year period, 2019 – 21. This eliminated any confusion around the beginning or end of the available data.

Since our goal was to study the impact of cannabis purchases, we focused on a subset of patients who either started or stopped using cannabis at some point during that time period. Future research may also consider changes in the quantity or types of cannabis purchases.
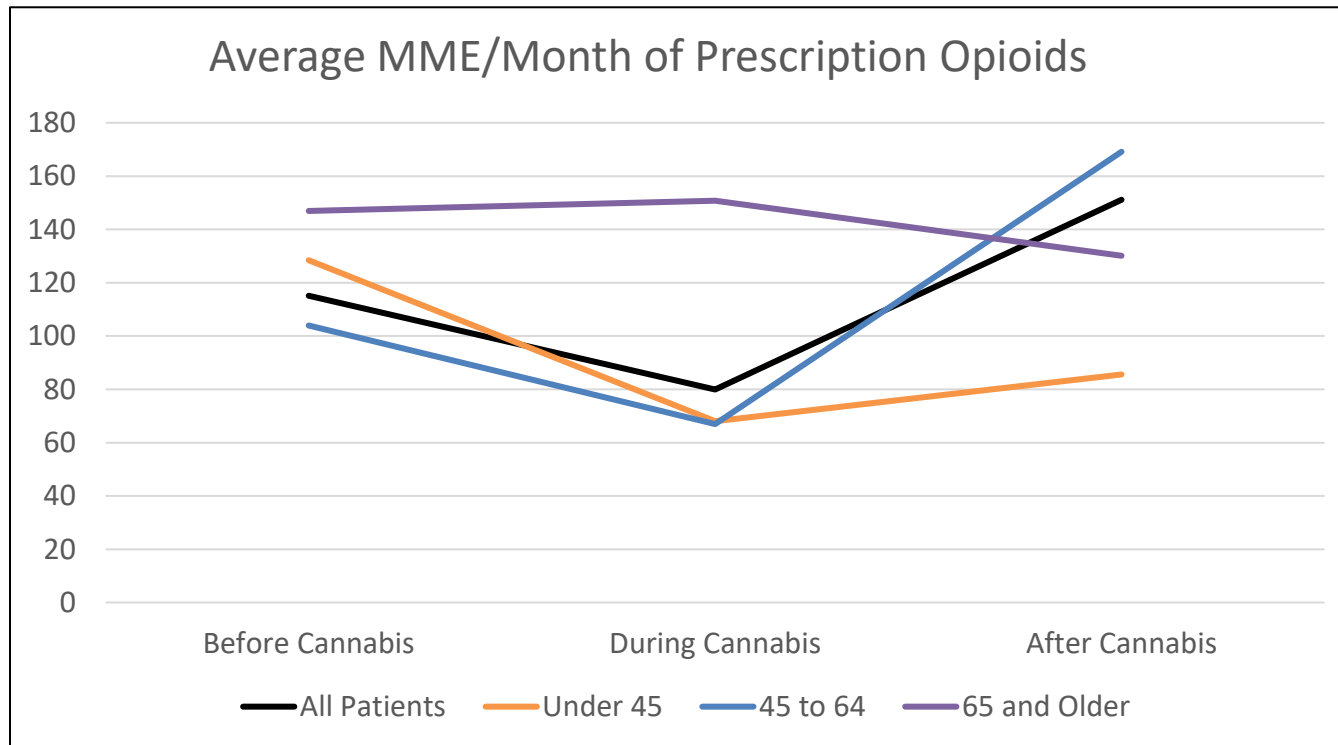
Normalizing opioid prescriptions by Milligrams of Morphine Equivalent (MME) per month we looked at the rate of opioid prescription:

- Before the first cannabis purchase

- Concurrent with using cannabis

- After the final cannabis purchase

Impact of Cannabis on Opioid Prescriptions

Cannabis Reduces Opioid Prescriptions by 30%

But the effects are not equal across all demographics. Younger patients, particularly younger females, show the greatest reduction in opioid use. Older patients show little change.

Average MME/Month of Prescription Opioids

Legend: All Patients, Under 45, 45 to 64, 65 and Older

X-axis: Before Cannabis, During Cannabis, After Cannabis

Cannabis Patients Reduce Opioid Use by 30%

There were significant differences between the two periods.

- Before using cannabis: 115 MME per month

- Concurrent with cannabis: 80 MME per month

These results show that patients who were using cannabis used fewer opioids, on average, per month. This reduction could come from fewer prescriptions, smaller prescriptions, or weaker drugs. Any of these would be considered a good outcome for reducing opioid dependency.

Results showed that opioid prescriptions increased again after a patient's final cannabis purchase, so this trend cannot be attributed to a general reduction in opioid prescriptions over time.

Average Patient THC:CBD Ratio & Product Form Dollar Spend

◆ Looking at the data for all the cannabis transactions we can establish a baseline of what an average patient looks like.

◆ The products can be grouped by form or by the ratio of THC to CBD.

THC:CBD Ratio	% of Dollars Spent
50:1	5.94%
19:1	59.42%
6:1	12.70%
1:1	7.93%
1:6	0.96%
1:19	4.76%
Only CBD	1.20%
Unknown Ratio	7.09%

Product Form	% of Dollars Spent
Vape - Cartridge	40.65%
Tablet	11.70%
Capsule	9.58%
Oil	9.02%
Vape - Syringe	8.62%
Oral	6.71%
Tincture	5.02%
Flower	3.37%
Other	5.33%

The product form percentages are skewed for certain products that were not available for the whole time-frame of the data.

19:1 THC to CBD Ratio Showed the Greatest Reduction

Those who were successful in reducing prescription opioids purchased more products with a high ratio of THC:CBD, spending more than the average on 50:1 and 19:1 ratio options. The 19:1 ratio was popular across all dispensary customers, but those who showed little or no reduction in opioids purchased more of the evenly balanced products.

THC:CBD Ratio	% of Dollars Spent on Cannabis Products		
	All Patients	Greatest Reduction	Little or No Reduction
50:1	5.94%	6.83%	8.12%
19:1	59.42%	70.20%	53.24%
6:1	12.70%	7.69%	13.95%
1:1	7.93%	7.83%	16.54%
1:6	0.96%	0.47%	1.05%
1:19	4.76%	2.23%	1.12%
Only CBD	1.20%	0.40%	0.07%
Unknown Ratio	7.09%	4.34%	5.92%

Tablet Product Form Had Greatest Reduction

We conducted a comparable analysis on product forms. If we can better understand which products are most helpful in reducing opioids, then we can help patients make informed decisions and give them the greatest chance of success. For example, those who successfully reduced their opioid prescriptions spent double the average on tablets.

Product Form	% of Dollars Spent on Cannabis Products		
	All Patients	Greatest Reduction	Little or No Reduction
Vape - Cartridge	40.65%	45.14%	42.29%
Tablet	11.70%	23.84%	11.60%
Capsule	9.58%	3.99%	10.10%
Oil	9.02%	1.66%	7.57%
Vape - Syringe	8.62%	4.61%	12.15%
Oral	6.71%	3.94%	6.69%
Tincture	5.02%	7.73%	2.93%
Flower	3.37%	1.24%	2.00%
Other	5.33%	7.85%	4.67%

Cannabis Patient Behavior—Preferred Form

Age and gender are conflating factors when it comes to analyzing preferred forms of cannabis, and their effectiveness in reducing opioid prescriptions.
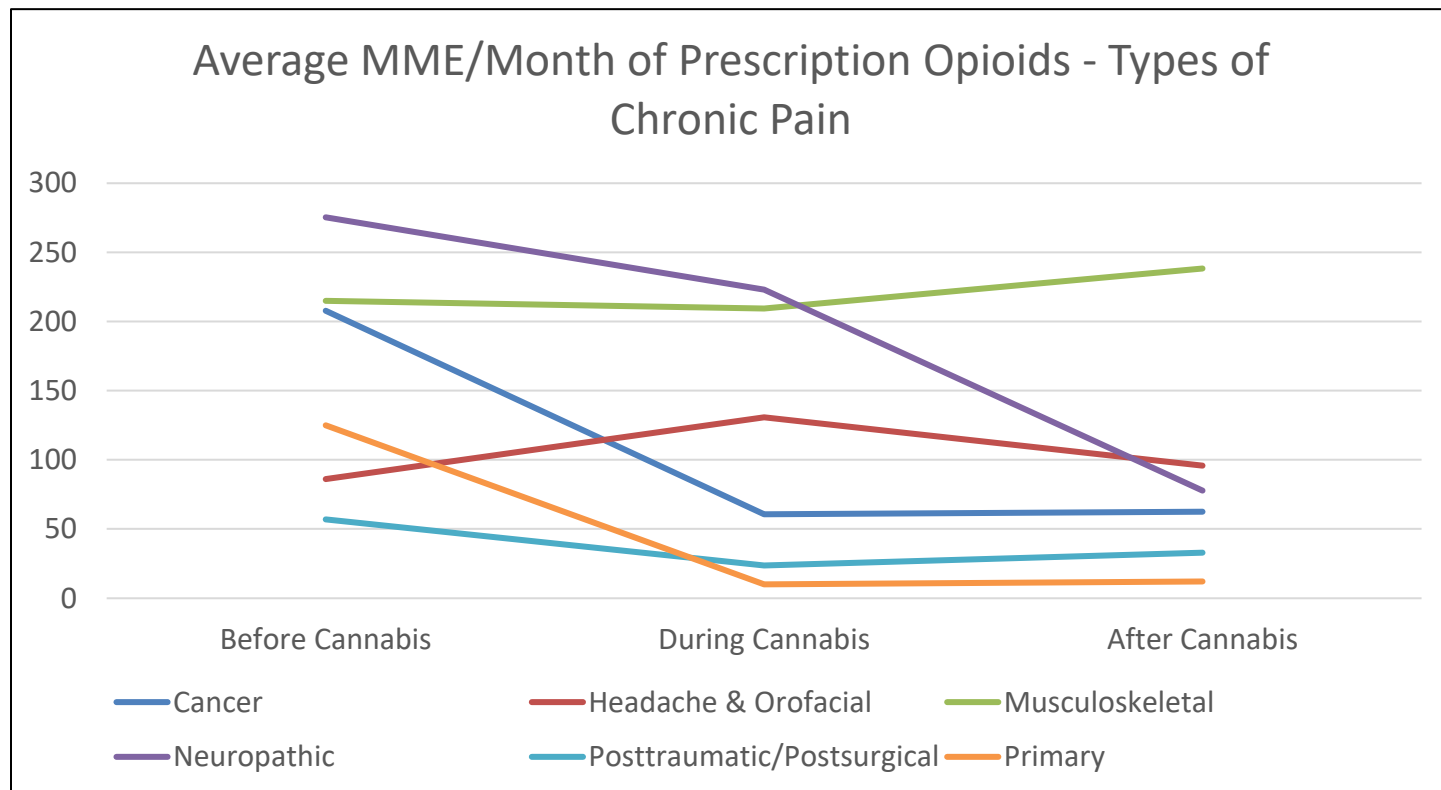
♦ Older patients are more likely to prefer capsules and tablets.

♦ Younger patients are more likely to prefer flower and vaping cartridges.

♦ Males are more likely to prefer flower.

| % of Dollars Spend on Cannabis Products | | | | |
Demographic Group	Capsule	Flower	Tablet	Vape - Cartridge
Female, Under 45	4.4%	8.8%	12.4%	53.4%
Male, Under 45	3.1%	12.4%	8.1%	50.0%
Female, 45 - 64	8.9%	3.9%	20.2%	39.3%
Male, 45 - 64	5.9%	7.8%	16.4%	39.5%
Female, 65 and older	13.9%	1.4%	37.3%	15.8%
Male, 65 and older	11.3%	3.7%	28.3%	27.9%

Cannabis and Opioid Reduction Across Pain Types

Opioid users can be studied by Type of Pain

Patients with chronic cancer pain, and chronic neuropathic pain showed the greatest percentage decrease in use of prescription opioids during cannabis use.

Average MME/Month of Prescription Opioids - Types of Chronic Pain

Higher Amounts of THC Doesn't Correlate with Better Results

THC Consumption in mg/Month

Legend:
- Opioid Reduction (Avg. 418 mg)
- No Opioid Reduction (Avg. 563 mg)

Shaping the Future- Achieving Success in the Cannabis Industry

♦ The following slides show MSA's research capabilities in the cannabis industry.

1. Segment Customers by Health & Wellness Measures
2. Target Doctors for Outreach Programs
3. Adjust Product Mix Based on Health Conditions
4. Market Share by Health Condition
5. Product Analysis for Cannabis Operators

♦ All data following is mock data.

Segment Customers by Health & Wellness Measures

◆ Customers purchase cannabis products for a wide range of reasons. By combining sales and health care data, MSA can determine which health conditions drive the most sales. Additionally, we can identify which products, or types of products, are most popular.

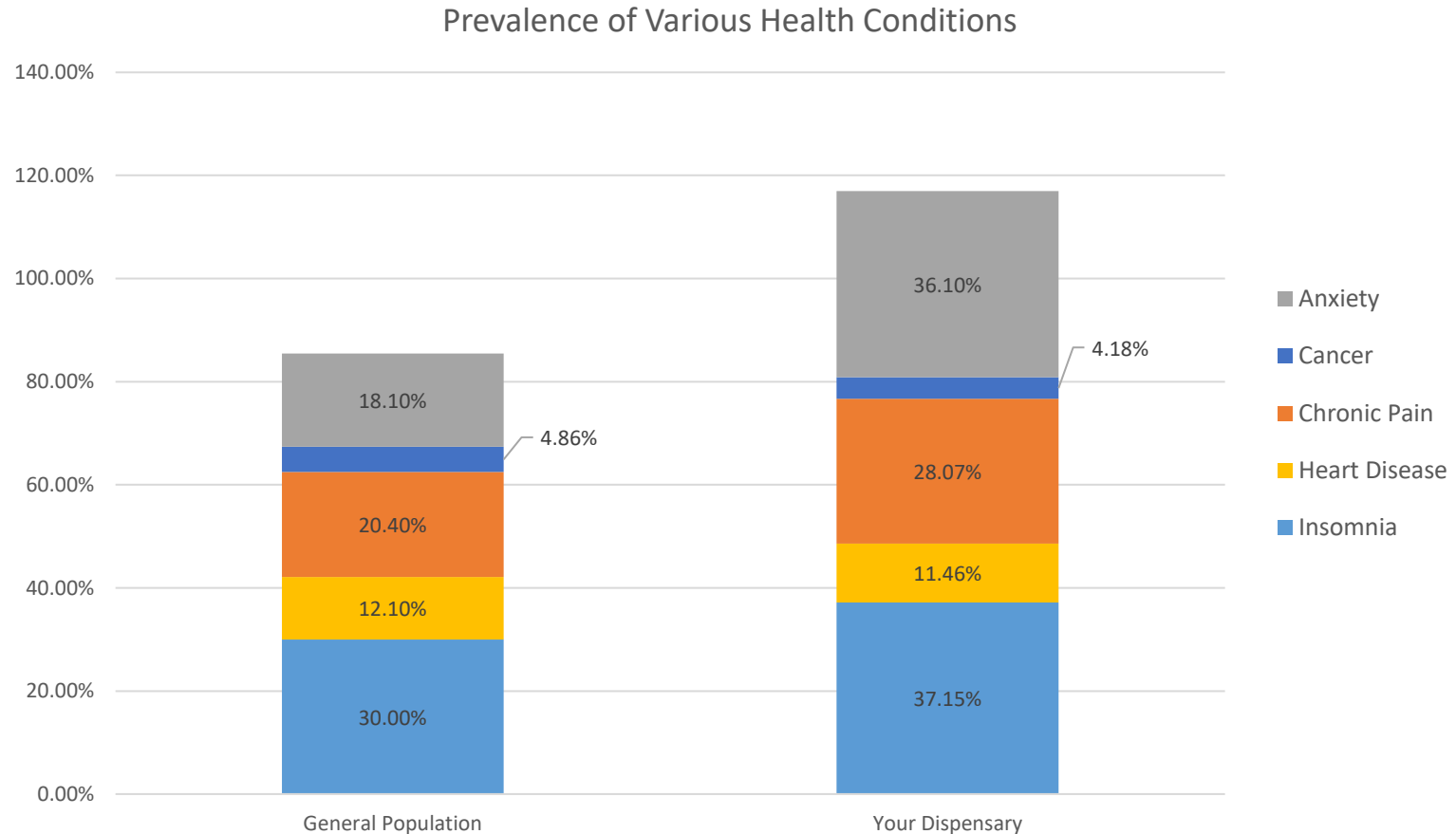|	Dispensary A	Anxiety	Cancer	Chronic Pain	Heart Disease	Insomnia
Distinct Patients	837	303	35	235	96	311
Visits	2,847	1,082	117	1,046	216	1,114
Visits per Customer	3.40	3.57	3.34	4.45	2.25	3.58
Total Sales	$127,520.50	$31,673.10	$4,520.25	$42,109.00	$12,890.50	$38,420.25
Sales per Customer	$152.35	$104.53	$129.15	$179.19	$134.28	$123.54
Demographic Breakdown						
Female	499	170	19	147	43	155
Male	338	133	16	88	53	156
F21-29	85	44	1	24	3	37
F30-39	81	39	4	28	4	48
F40-49	82	36	5	21	5	26
F50-59	108	27	4	35	14	23
F60+	143	24	5	39	17	21
M21-29	54	24	0	6	2	22
M30-39	52	36	2	13	0	25
M40-49	45	32	0	18	6	42
M50-59	85	26	6	22	18	44
M60+	102	15	8	29	27	23

Target Doctors for Outreach Programs

◆ MSA reporting provides visibility into the number of patients by health condition by location and identifies how many are existing customers. This empowers dispensaries to create outreach programs to grow their customer base and measure success.

Doctor	POOLE , AUSTIN		HERNANDEZ , ERIC	
Specialty	Int. Med. - Oncology		Family Medicine	
Address	4715 ARAPAHOE AVE, BOULDER, CO, 80303		1949 PEARL ST, BOULDER, CO, 80302	
NPI	1053686253		1124288089	
	Patients	Dispensary Customers	Patients	Dispensary Customers
Anxiety	0	0	31	0
Cancer	342	11	19	0
Depression	0	0	18	0
Diabetes	0	0	29	0
Heart Disease	0	0	40	1
HIV	0	0	15	1
IBD	0	0	17	2
Insomnia	0	0	18	1
MS	0	0	26	1

Adjust Product Mix Based on Health Conditions

◆ Better understand market drivers and identify growth opportunities specific to your market.

Prevalence of Various Health Conditions

Legend:
- Anxiety
- Cancer
- Chronic Pain
- Heart Disease
- Insomnia

General Population:
- Insomnia: 30.00%
- Heart Disease: 12.10%
- Chronic Pain: 20.40%
- Cancer: 4.86%
- Anxiety: 18.10%

Your Dispensary:
- Insomnia: 37.15%
- Heart Disease: 11.46%
- Chronic Pain: 28.07%
- Cancer: 4.18%
- Anxiety: 36.10%

Note: Since an individual may have more than one condition (or none) the percentages need not sum to 100%.

Market Share by Health Condition

◆ By linking sales and health care data, we can see how effective a brand is at reaching a demographic. A fair share greater than 1 indicates a brand is more effective in reaching that demographic. A fair share of 1 or less may indicate an opportunity.

| Brand | Market Share | | Pain Management Fair Share | | | |
	Total	Pain Management	Current Year	Previous Year	% Change YOY	Potential Gain
Ayr	5.23 %	4.90 %	0.94	1.04	- 9.91 %	$12,076,750
Cresco Labs	7.74 %	9.03 %	1.17	1.05	+ 11.11 %	$0
Fernway	3.10 %	3.27 %	1.05	1.15	- 8.27 %	$3,484,000
GTI	8.80 %	7.20 %	0.82	0.88	- 7.02 %	$30,820,000
Happy Valley	3.82 %	4.20 %	1.10	1.16	- 5.22 %	$2,579,500
MariMed	3.99 %	4.04 %	1.01	1.07	- 5.37 %	$6,180,750
All Other Brands	67.32 %	67.36 %	1.00	0.98	+ 2.10 %	

Potential gain is based on a brand's ability to equal the top brand's fair share (in this example, Cresco Labs). The calculation assumes that patients with pain management concerns make up ¼ of the total market.

Product Analysis for Cannabis Operators

◆ Manufacturers can gain insights into the effectiveness of their brand and product form for treating patients with pain and a history of opioid therapy. The table below shows the number patients using each brand and the percentage of patients with an opioid prescription in the past 30 days.

Manufacturer/Product Type	Total Customers	Filled Prescription (last 30 days)	Opioid Prescription %
Cosmic Connections	**572**	**96**	**16.8%**
Cartridge	340	83	24.4%
Flower	291	16	5.5%
Dr. Jones Medicinals	**398**	**62**	**15.6%**
Pill	398	62	15.6%
Fantasticals	**702**	**151**	**21.5%**
Beverage	410	81	19.8%
Pre-Rolled	311	96	30.9%
Tincture	187	21	11.2%
Gummies 'R' Us	**316**	**66**	**20.8%**
Edible	316	66	20.8%
Quiet Forest Organics	**684**	**130**	**19.0%**
Cartrtidge	163	58	35.6%
Flower	487	39	8.0%
Pre-Rolled	206	72	35.0%
Sweet Serenity	**245**	**49**	**20.0%**
Edible	245	49	20.0%

MSA Partners with BDSA

- ◆ BDSA is the leading provider of data and insights for the cannabis industry through providing retailers, manufacturers, brands, wholesalers, and investors with actionable insights to drive profitability, increase revenues, eliminate expenses, and outmaneuver the competition.

- ◆ Through MSA's capability to analyze real-world data in coordination with BDSA's extensive insights into the cannabis industry, we offer one-of-kind advisory to help understand your consumers, influence business, sales strategies, and more.

Partnering with MSA

MSA delivers groundbreaking insights into the intersection of cannabis purchasing behavior and real-world health care data. Partnering with MSA enables cannabis operators, government agencies, academia, and health care professionals to identify new opportunities in research and education while further legitimizing the cannabis industry.

To learn more, please contact:

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Since 1963, Management Science Associates, Inc. (MSA) has partnered with customers to identify areas in which innovative analytics and applications of data and systems drive growth and create efficiency. Combining its expertise with the tools of information management, analytics, data management, systems engineering and support, MSA develops, integrates, implements, and maintains solutions, products and services for a number of industries. Since 2013, MSA has been developing extensions of its success in CPG, healthcare, media, metals, and information processing into the high growth cannabis industry.

Management Science Associates, Inc.